SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Original Correspondence.

PROCESSES OF MINING IN SOUTH AMERICA.

TO THE EDITOR OF THE MINING JOURNAL.

Sir,—The countries of South America present so many interesting features in relation to mining, especially for the precious metals, and so little information is current as to the processes there in actual use, that some sketch of the state of mining matters on either side of the Andes may appropriately find a place in your Journal. The information has, of course, its chief value in reference to the desirability of investing British capital in South American mines, and the results to be anticipated from a more extensive introduction there of those improved methods which mining experience in California and British Columbia would suggest. Unhappily, political elements have to be taken into consideration in determining the safety of capital; war, or rumours of war, between the separate states affecting the carrying on of those internal improvements, or the availability of established routes, which facilitate communication from the interior to the coasts.

Each locality of South America, where mining operations are carried on, may be said to possess its own traditional modes. Neighbouring provinces will present a complete variance in these modes, whilst not dissimilar processes will be found to be carried on in localities thousands of miles apart. This results in the way mining information has been diffused, such as the movement of large bodies of mining labourers from one region to another, and the nomade habits of mining speculators, who as buyers, sellers, or workers of mines, factors of companies, or traders in the precious metals, diffuse widely the results of their own experience or observations. Let a piece of silver ore be shown to one of these men, and it is astonishing with what accuracy, though, of course, only in the way of inference, he will denote the province and the portion of the district from which it came. Nowhere have exterior metallurgic indications been so closely and accurately studied as in South America; nowhere else either is it so comparatively easy to become the possessor of a gold or silver mine or vein, whether by discovery or purchase. Hundreds upon hundreds of owners of mines, whose attention is taken up by agricultural pursuits or trade, are willing to dispose of abandoned mines on their estates, or newly-discovered veins, at an almost nominal price paid down, or to compound for a percentage on prospective gains. The mining laws are exceedingly favourable to foreign enterprise, resulting from the fact, everywhere conceded, that the full development of the metallic resources of those countries can only come from the investment of foreign capital, and European skill and energy supervising its outlay.

Even in that continuation of the Andes called the Isthmus of Panama gold is found, chiefly by the streams or rivers, and the negroes to the south of Darien employ their time intermittingly in the collection of the golden grains. Mining operations here are *nil*, but it is worth noting the existence of the once celebrated mines of Cana or Espirita Santo, which during the Spanish occupation yielded annually 100,000 castellanos of gold. The miners who came after the Spaniards were driven out had not sufficient wealth to restore them—that is, to put them in order again. Just at the time of the Yankee filibustering expedition under Walker, they were about to be re-opened, but this occurrence, together with the attacks of the Indians, put a stop to the attempt. Native enterprise will accomplish nothing on this isthmus. The sands of the rivers Marea and Balsas, Coclé, Belen, and Rio de los Indianos are left to the Indians, who separate the precious grains by purely mechanical means. From one mine, however, that of San Antonio, in the province of Coclé, the Government manages to obtain 10,000*l.* annually. This mine is under the direction of experienced Mexicans, and Mexican modes of pulverising the quartz and amalgamating and retorting the gold are adopted.

Leaving the Isthmus of Panama, we come to New Granada, situate in the torrid zone, yet possessing, from its different elevations, all varieties of climate. There is gold along the entire course of the Magdalena, and an immense amount of auriferous and argentine wealth in the valley of Cauca. This valley abounds not only in veins of gold and silver, but of copper, iron, and coal. Some of the gold veins of New Granada lie beneath the most barren slopes, as though the surface had been blasted by mephitic exalations attendant on volcanic action; other mines are situate beneath a deep and rich soil, supporting flourishing vineyards, or rich forests of balsamic and resinous trees. The Indians of New Granada were too warlike to give the Spaniards much peace, but these found and worked four mines, which yielded large returns, and there are now men who obtain considerable sums by following to their source traditional stories of quantities of gold and silver hid by the Spaniards in caves, or thrown into lakes for safe keeping. A whole tribe of Indians have for their title a term signifying "Hidden Gold," and are credited with a knowledge of gold mines they will not disclose. There are placers in New Granada where gold is found in sand, and so rich that four yards square has yielded as much as 10 pounds of gold. Many rich mines that have been opened have not been wrought. It is believed that there is plenty of gold in the alluvial districts of Muzo and Otro-Mundo, and in the well-known Corcobada, which flows into the River Carare. It is certain that one old negro, near Otro-Mundo, used at times to bring a good quantity of gold dust to the market of Chiquinquira, and could never be persuaded to say from whence he obtained it. He died, and his secret with him. During the summer months the New Granada native may be seen, at almost any hour of the day, burrowing for gold in the flats. Sinking a square hole some 4 or 5 ft. deep to the bedrock, he carefully collects all the sand or earth lying immediately on the ledge into a wooden batea, or pan, which he carries to some neighbouring shade, and there pounds up the hard lumps of earth until nothing but dust remains. A bullock's hide is now spread out upon a level spot, when the New Granada miner raises the batea above his head, and with an oscillating motion shakes out the dust upon the skin until all of it has fallen. This process is renewed for a number of times, until very little of the original mass remains, which is carefully collected, and placed in a pile separate from the unpounded earth. When it is found that the claim promises to yield a satisfactory return, the Granadian returns to his hole, and commences to cut into the sides just above or adjacent to the bed rock. He is a species of badger miner. Sticking closely to the ledge, he will burrow with a light crowbar for a distance of 6 or 8 ft., ascending or descending with the ledge, following it closely, and carefully scraping up the earth upon its surface. The New Granada miners seldom use any other tool than the crowbar, the batea, and a horn spoon, with which latter the soil is raked up after being loosened by the bar. It is common to see a gulch, flat, or hill all alive with these burrowers. Dry washing requires considerable sleight of hand in working to advantage. A windy day is preferable, as the fine dirt is then more rapidly carried off from the gold, the great density of which removes all fear of its being carried off from the hide. There are many instances of small fortunes having been realised by this manner of washing.

But it is in yet more southern regions—in Peru, Chili, and Brazil—that gold mining is carried on to any great extent. Both the cordilleras of the Andes in Peru are rich in gold veins and silver ore. It is only, however, on the eastern cordillera where *lavaderos*, or pure washed gold, is found. On the banks of the Peruvian river Tipuani, which rushes with immense rapidity and power first through narrow rocky defiles, and then flows through a country covered with thick forests, wild barley, bananas, and sugar-canes, are found abundance of gold in the most extraordinary manner, and in wonderful purity, it being 23½ carats. The gold presents itself in little grains of the size of barley-corns, but sometimes in large lumps. The miner sinks a large shaft close by the edge of the river, continuing the shaft until he meets with a pan of slate, which is called Penna; the water is then taken out by the Indians with buckets, one standing above another. This is a most tedious and expensive operation, and frequently occupies two or three months of the dry season. The Indians receive for this service 6*s.* a day, and there are frequently 200 employed in one mine. After the water is exhausted, galleries are dug in different directions, according to the course of the metal, and in these the gold is found, mixed with a hard blue clay, which is all taken out together. The gold is found along the whole surface of the banks of the river; the traveller may ask to have the experiment tried at any point, and it never fails. This gold and clay together are put into a canal constructed with slate, and the bottom of which is an inclined plane; a current of water is then introduced, which washes away the clay and earthy particles, and leaves the heaviest particles of the gold behind, which are collected and put into sacks, and carried to La Paz, where they are cast into plates or ingots of 4 lbs. each, which are worth 200*l.* The light grains washed away by the water are afterwards picked up by the poor people, who sometimes employ quicksilver for the purpose. The workmen employed in the mines depend more on their opportunities for thieving than upon their regular wages as a compensation for their services. They have a dexterous mode of throwing bits of gold into their mouths as they pick them up, in which way they collect considerable quantities, in spite of the vigilance of overseers. When the banks of the river are very high, canals are dug to drain off the water. Rocks found upon the surface are sometimes removed by blasting with powder, but this proves an expensive operation.

In conducting these *lavaderos*, or washings, every operation is carried on in the most expensive, rude, and slovenly manner, and machinery is dispensed with. The expenses of working a mine are frequently 3000*l.* in three months, and there are such losses from the pilfering by workmen, that a large product is necessary to profit. The annual product registered as derived from the Tipuani is 40,000 ozs., but this does not include the quantity used for private ornaments, or pilfered. In the neighbouring province of Carabaya, the river is of the same character, and the yield registered by the Alcede, so far, amounts in value to 7,000,000*l.* These mines were worked in the times of the Incas, who appear to have been well acquainted with the richest mines of the country, and tools of copper or tin that belonged to them are frequently found. The gold is conveyed from Tipuani in sacks of skin, which are carried to La Paz by Indians, with perfect security through the thick forests. The gold in the Peru mines is usually found embedded in white and blue quartz, frequently combined with other metals, especially silver.

The ridges of the mountains as one goes north from Ancoma are full of mines of gold, and at the villages of Ananes and Yani rich mines are worked. It is a remarkable fact in the geological history of this territory that, so far as Peru is concerned, the gold mines, travelling up from the south, commenced at Ancoma (lat. 15° south), and only present themselves as one travels north and east, whilst towards the south is situated the region of silver. The peak of Ancoma, like another equator, divides this metallic region into two hemispheres—that of gold on the north, and silver on the south. In this province and the neighbouring province of Carabaya are the famous rivers where the pure washed gold is found.

In hilly regions on spurs of the Andes, in Chili and Peru, the grinding mills of the miners are turned by national or artificial lakes, the latter having commonly in the first instance been formed to supply the neighbouring towns with water. It is a remarkable fact that, notwithstanding their great elevation, these lakes are never frozen over, although there is much frost in their neighbourhood on the mountains. It frequently happens that these supplies of water fail, for want of rain, and then the mills are stopped, and the operations of the miners in extracting the metals suspended. The machinery used in crushing the quartz rock is not generally expensive, and is commonly greatly dependent on manual labour. Consequently, the modes adopted present no features of interest after the survey of those in use in California, where steam and the principle of hydrostatic pressure in its most simple form have been introduced as powerful agencies to save time and expedite work. The blasting process, though comparatively rarely resorted to, is found most expensive, from the high price both of the requisite tools and gunpowder. A trunk of a tree, with a large granite boulder placed in its fork, is frequently used as a lever in the process of crushing the rock.

In several of the interior provinces soft quartz is ground, and calcined quartz pulverised, by stones similar to English burr millstones, used in grinding corn. The purpose in baking the ore is to drive off the sulphur lodged in iron and copper pyrites. Hammers are also extensively used. The auriferous quartz after being reduced is carried down a trough lined with hides by force of an applied stream of water. The hair of the hides having been so disposed as to lie against the current, numerous particles are thus collected. Mercury is not allowed to touch the gold before it passes over this hair, for mercury in coating the particles of gold renders them globular, thus destroying the natural angles by which they might otherwise be caught. A coarse and rough blanket is also employed for the same purpose as the hide. The flow of water and quartz is checked by tanks, where the current eddies, and passes off, leaving the heavier quartz to settle at their upper end. This heavier quartz, together with what is lodged in the trough, and the gold the hide or blanket may contain, is then taken to be amalgamated and ground in a Chilian mill. To preserve the roughness of the skins they are rinced in water every half-hour, and the richer ore is each time removed along with them. The quartz thus removed is then stirred in mercury by the fingers of an Indian, after which it is ground, in order to crush the coarser particles and the iron pyrites, and finally disposed of in amalgamators and quicksilver troughs. As to the pulverised quartz not thus secured, and which has passed freely away, the current after sweeping out of the tanks passes in divided streams onwards and downwards, checked by successive bowls, containing mercury, arranged one below the other.

In the rude arrastra the bed is paved with unhewn flat hard stones, usually laid in common dirt, and sometimes in clay and cement. The batch of quartz within this walled area is crushed by a stone attached by chains to the extended arms of a central post, the hind end of the stone alone drags, and the branching arm or arms, as one or two flat stones are used, are dragged by mules or Indians. Quicksilver is not added until the pulverised quartz and water have made a consistent pulp; the amount of quicksilver introduced is commonly determined by mere guess-work, according to the supposed wealth of the ore, judged from the general character and appearance of the mine from which it was extracted, and the estimated results of past experience. The breaking of the quartz to fit it for the bed of the arrastra is commonly done by hand. When the paving of the floor of the arrastra is rude, the quicksilver is found to settle down between the crevices, and two or three successive lots of quartz are reduced before the pavement is dug up, and the dirt brought together to be washed, so as to save the amalgam, which is then retorted. In the superior arrastra the quartz or porphyry floor is closely dovetailed. As to the proportions of quicksilver applied for the purposes of amalgamation, it may be laid down that ¾ lb. of quicksilver is applied for every 100 lbs. of gold in the mass, and the scattering is done by means of a canvass bag, into which the quicksilver is put. The mules having been driven through the mass for several hours each succeeding day, until all the quicksilver is taken up, a lesser quantity of quicksilver—¼ lb. for every 100 lbs.—is superadded, again to be trodden in, when the last addition is made —⅜ lb. of quicksilver to every 100 lbs. of ore. During the process the condition of the amalgam is examined.

Amongst other devices in use is an amalgamating copper trough, of oblong form, the bottom provided with small basins; quicksilver is poured in, so as to cover the bottom, and as quicksilver amalgamates with copper as with gold and silver, the quicksilver is constantly presented at the surface ready to catch the gold. Revolving bowls containing loose quicksilver, and bowls admitting of being violently shaken, so that the pulverised quartz may be thrown from one compartment to another.

[*To be concluded in next week's Journal.*]

THE EDMUND'S MAIN COLLIERY EXPLOSION.

In the very valuable paper upon this subject, read before the Manchester Geological Society, by Mr. Thomas Farrimond, it was remarked that the mode of working the mine was the pillar and stall system. As the levels are being driven stalls are entered at right angles, or nearly so, upon the face of the coal. He presumes, as they are nearly east and west, first a pair of drifts are started with a pillar of coal about 5 or 10 yards thick; this is followed by a pillar 30 or 40 yards thick, and then a drift, and again follows another thick pillar of about the same dimensions. Openings are cut through these thick pillars about every 20 yards, and then again comes a drift, again a pillar of 5 to 10 yards, and this process is repeated. It will be seen that the pillars are not all the same thickness, as in bord and pillar work they generally are. In this Yorkshire system we have first a pillar 5 to 10 yards thick, then the two next pillars are from 30 to 40 yards thick, and again a pillar 5 or 10 yards, and so on. The object in having these two thick pillars is to be enabled to rib or widen the drift between them, and so to be working the pillars back while cutting out the places, and finding working places for the colliers in a shorter time than if the bord and pillar system were properly worked; for as soon as the drift between these two thick pillars gets about 20 yards up, openings intersect it right and left, the collier working the drift conveying his coal through the opening, and then two ribbing places commence from the level again on each side this drift, and when they get to the opening turn back to the level, and take two more ribbings off in the same manner, and by this time the drift has put through into another opening through, which he again takes his coal, and makes room for two more ribbing places from his second opening. In this manner it is continued until it reaches the levels above—every opening furnishing two more places. It will be seen for what object the two drifts are left standing with the pillar of 5 to 10 yards between them. After the ribbings have been completed to within a certain distance of the drifts, they are left to be filled full of gases, and become standing goafs, not sufficiently large to let the roof come properly down, as in the wide work system, but, nevertheless, so much so as to prevent their being ventilated; and if the mine makes gas at all they become dangerous reservoirs of this explosive mixture, ready to come out upon the open lights, either by a fall of roof or barometer. This system of working is highly dangerous, and should never be adopted in mines that make the slightest quantity of gas, unless they are worked exclusively with safety-lamps; and even this would not be safe, unless the mine was properly managed; for the firing of shots, which could not be avoided, is always attended with danger where lamps are exclusively used. The only safe mode of working is the bord and pillar system, and he is certain the most economical, as the coal will not be so much crushed. The three pillars left, upon this Yorkshire system must be expensive to work back, and very much crushed—the two drifts being necessary for air to the same during their working. After alluding to the position of affairs underground upon the morning of the explosion, as elicited at the coroner's inquest, he observes that when the second explosion occurred at 5 minutes to 1 o'clock, he should certainly have been astonished if the furnace fires had been found in, as James Shigley, the furnaceman, left the fires at 15 minutes to 11 o'clock in consequence of the smoke, came out of the pit and reported it to George Lawton, therefore there had been no fuel put on the fires for three hours, and, moreover, the cinders had been swept out by two explosions, as attested by the persons who were at the shaft bottom, when the same occurred Mr. Maddison and a party of eight men went down the pit at 30 minutes past 2 o'clock. It will naturally be asked what had been done since 10 o'clock? The answer is—nothing beyond a consultation, which had been held for about one hour and a half. Was the question of how to rescue the 52 unfortunate individuals of so difficult a nature as absolutely to require this time? Certainly not. There was only one method to adopt—the repairing of the crossing at the shaft, sending all the air into the downbrow, and rebuilding the stoppings and crossings therein, and by that means to restore the ventilation, and liberate the persons. However, they descended the shaft as above stated, and found the main crossing from the downbrow blown out—this crossing carries the return air from the downbrow over the shaft level—and they found smoke coming up this downbrow, and going to the upcast shaft. There could be very little smoke coming up, as the air from the downcast shafts would fill this return completely full, and virtually lay stagnant all the downbrow workings. Mr. Maddison and party, without attempting to restore this crossing, or put a stopping in the level, which would have answered the same purpose, proceeded along the downbrow intake, and succeeded in getting about 120 yards down, and passing six stoppings, which are at intervals of 20 yards; four of them they found more or less blown down, one remaining good, and the last completely demolished; and upon Clegg, one of the party, going a little further down he was lost sight of, the smoke being so dense. Again, Mr. Farrimond asks—"Did Mr. Maddison believe that because he found the downbrow full of smoke it followed that all the downbrow workings, benks, blows, levels, &c., were full also? If he did so, and I am undoubtedly of opinion that such is the fact, he is more to be pitied than blamed, and the responsibility rests with those who brought him to the colliery and put him in such a responsible position;" but he considers that however indiscreet Mr. Maddison may have been, he is the person upon whom responsibility should be thrown.

The discussion which followed the reading of the paper was particularly interesting. Mr. Goodwin would not have sanctioned the mixed use of safety-lamps and naked lights in such a mine, because of the quantity of stored up gas that surrounded the workings, but considered that they could not class it as a mine that was generating much gas, for the naked candle was generally used there. It is a question which admits of various views, whether the system adopted was a good one or not. But he was astonished to find Mr. Farrimond condemning the pillar and stall system, which at the last meeting he advocated; he was now asking for it to be removed.—Mr. Farrimond said that he advocated a wide work system. He had introduced it into two collieries, but had much difficulty in getting it done, having, in fact, to pay the colliers an extra amount to do it. Now, however, they are quite used to it, and he could not persuade them out of it if he tried. By it a colliery can be worked cheaper and ventilated better.—Mr. Binney thought that the investigation concerning the Edmund's Main explosion proved that viewers, managers, and colliers were but little acquainted with the nature of fire-damp. He was sure no men would run the risk of loss of life and property if they only know what a terrible enemy they had to deal with in the shape of fire-damp. He condemned the mixed use of lamps and naked lights some years ago, and did not know how it was that in most of the Yorkshire mines they use mixed lights still; it was on that point that he wished to ask Mr. Goodwin whether he called it good management of a colliery to have the two descriptions of lights in use.—Mr. Goodwin said that he should condemn the system at once; but in the case of the Edmund's Main there were very few lamps used, and those were in a separate part of the workings. The majority might be said to be working by candles, and the mine was generally worked by candles. If he had his choice to-day he would do the same in many mines. He had seen a good many collieries, and would sooner take the candle to-day with all its failings, than the Davy lamp, where the getting of coal is not properly conducted. Of course, he did not say that the candle was safe in the hands of everyone; but with careful management it will do a great deal, and is much better than many suppose. It is making these places a huge receptacle for 'gas that forms the danger.—Mr. Binney: Hence the danger of using candles.—Mr. Goodwin said he had seen collieries well and safely managed with them. As for accidents, they are unavoidable as long as mining operations are carried on.

THE COAL MINE INSPECTION ACT, AND ITS WORKING.

THE GOVERNMENT INSPECTOR'S DIFFICULTIES.

We have upon several previous occasions pointed out the almost innumerable difficulties which the Government Inspectors of Coal Mines have to contend with in the performance of their duties, and the many obstacles which are met with in the attempt to secure to the working collier even the small amount of protection against avoidable accidents, which it was hoped the Act of Parliament now in force would afford him; and we have now again to allude to the subject, in consequence of the result of a case which was heard before the Whitehaven magistrates on Thursday and Friday last, when Mr. Matthias Dunn, Government Inspector of Mines for Durham, Northumberland, and Cumberland, appeared to support a complaint made by him against Mr. Bailes, viewer of the collieries worked by the Whitehaven Hematite Iron Company, alleging a breach of the statute in not having sufficiently provided for the ventilation of one of their pits. Although we do not wish to infer that anything like personal feelings would be likely to influence the decision of any court of justice, we cannot help noticing the circumstance that Mr. James Lumb (with Messrs. John Thompson, John Postlethwaite, S. Lindow, and R. Barker) is a director of and partner in the Whitehaven Hematite Iron Company, that Mr. William Lumb was one of the magistrates before whom the case was tried, and that Mr. Wm. Lumb, jun., conducted the case for the defendant. We have ever maintained that the provisions of the Inspection Act should not be made to press with unnecessary severity upon the coalowners, but, on the other hand, we think that the lives of the colliers are too valuable to justify the Government Inspectors in permitting the strict observance of the Act to be neglected.

The simple fact that since 1850 Mr. Dunn has come but once before a Court with a similar case is of itself a guarantee that the complaint was not altogether ungrounded, and it is acknowledged, both in his district and out of it, that it is only when all other means have failed that he resorts to legal proceedings. But if another proof were wanted, it is readily supplied in the circumstance that the Court was crowded by a large body of colliers—a class well known to absent themselves from law courts when they believe the coalowners whose management is questioned to be free from blame. Mr. Webster, who appeared for Mr. Dunn, stated that the information was laid against the defendant under the 10th section of the 23d and 24th Vict., c. 151, the first rule of which provided for the adequate ventilation of mines under ordinary circumstances. So long ago as Feb. 10, 1862, Mr. Dunn called the attention of the directors of the Whitehaven Hematite Iron Company to the state of the pits in question. Shortly after an accident occurred in the very pit respecting which this enquiry was now going on, whereby two men were killed. Mr. Dunn then called the attention of the directors to the improper working of their colliery, which was such as to hinder its sufficient ventilation, and to keep it free of gas. On Feb. 11, Mr. Dunn and Mr. Atkinson, Government Inspector for the southern division of Durham, who had been sent there to assist Mr. Dunn in his investigation, went down the mine, and found gas, and that the working places were not in a state to allow of proper ventilation. They went into one man's place, and on applying the lamp it fired; and both gentlemen would prove that if a naked light had been exposed an explosion would have followed. They would also tell the Bench that the trattcing was very thin, that Mr. Bailes himself said it was not in a very good state of repair, and that the stoppings, which ought to have been of stone or brick, were of wood, and likely to leak. Mr. Webster then drew attention to clause 16 of the Act, defining the powers and duties of Inspectors. He regretted that the course taken by the directors of this company had prevented Mr. Dunn from carrying out his inspection of the pits in the way he could have wished. He applied to them on Jan. 27, that he might be accompanied by Mr. Steel, their former viewer. He believed the directors did not object, but on Mr. Steel and he going to the pit, the directors' agent, Mr. Bailes, did; and consequently Mr. Dunn was obliged to go down the pit himself, and examine it as he liked. On Feb. 2 he wrote a letter to Mr. Thompson, the managing director, requesting the company to be most careful in their examination of the tubs and ropes, and the following day—showing that his recommendation should have been attended to—the rope in Hope Pit broke, and caused considerable damage to the brattice down the shafts. In consequence of the conduct of the directors, Mr. Dunn wrote to Sir G. Grey to have Mr. Atkinson sent down. Mr. Atkinson went, and the result was as he had before stated. The 22d section of the Act gave the magistrates power to inflict a penalty not exceeding 20*l.* for non-compliance with the requirements of the Act. He might add that Mr. Dunn was preparing to lay different informations against this colliery, but he had selected this case, under the first rule.

It appears, that in consequence of an accident at the Hope Pit in 1862, which arose from an explosion, and by which two men were killed, Mr. Dunn saw Mr. Thompson, one of the company's directors. Having found the ventilation deficient, he recommended that the working, which was very high and wide, should be diminished one-half. The width of the coal was 4 yards; the drift was 8 ft. wide, and the full height of the seam. On Jan. 12, Barratt, a collier wrote the Inspector that the pit was in a dangerous state, and that he had received notice of discharge for threatening to write to the Inspector about it, and, in consequence of that letter, Mr. Dunn went to the collieries, saw the managers, and entreated them not to allow the man to be discharged until they had ascertained whether his story was true or false; cautioning them that they were taking a great responsibility on themselves. On Feb. 11, he went down the Hope Pit. He had

written to Sir G. Grey, and in consequence Mr. Atkinson accompanied him. Mr. Bailes was with them. Mr. Bailes, speaking generally, admitted that the bratticing in the shaft was deficient. The pit is a single shaft; the bratticing is its only safeguard, and its being deficient would prevent proper ventilation. Mr. Bailes did not say particularly how it was deficient; he spoke generally. At the time he was discussing with him what was necessary to put the shaft into better condition, and asked if it would not be better to stop some of the night-shifts to allow of it being done. He said it would. The brattieing was 1¼-in. thick; it ought to be a least twice as thick. Ordinary brattieing is 3 inches. Supposing an explosion had taken place that morning, he did not think any of the people's lives could have been saved. In order to ascertain the amount of ventilation he desired Mr. Atkinson to bring an anemometer. It would not work, which showed the want of ventilation. He had certified these special colliery rules as Government Inspector. There are several stoppings in this pit. Some of them are of stone. The object of their being of stone instead of wood is to carry the air more effectually. When made of wood, they are not only difficult to keep air tight, but they are liable to be blown in. Examined some of them that were made of wood, which, he should think, is a violation of one of the special rules of the colliery. Found the air in the main roads very deficient, and the workings in much the same state as they were the year before. They had been working them too wide for the quantity of air they had to fill them. The consequence was, that when the air got into a large space the current was not sufficient to drive up the gas. No doubt that was dangerous to the workpeople. Messrs. Dunn and Atkinson went into one of the workings, and desired the man there to put his lamp up to the roof. He did so, and the gas exhibited itself inside the lamp—in other words, fired at it. Had the light been naked there would have been an explosion, and the man in all probability burnt. This was a natural result of the bad ventilation, and he was not surprised to see it at all. They had curtains instead of doors at particular parts of the pit. These are not so effectual as doors. If an explosion were to take place ventilation would be destroyed, and the after-damp would suffocate the people. There is a cavity sunk about 2 fathoms at bottom of the shaft, and he thought it desirable to have a road made about it, in case of accident, lest the men running with their lamps out to the eye of the pit should fall in.

Mr. Dunn was under cross-examination for several hours, but the sole objects of the defence appeared to be to prove that Barratt's character was not good, without proving that the ventilation in the mine was sufficient, and to divert attention from the real case in point—whether the mine was adequately ventilated, and whether the brattieing (the pit appears to have but one bratticed shaft) was good or leaky?—a question of vast importance in connection with the consideration of the safety of the workmen. The cross-examination was, consequently, uninteresting in a practical point of view. Mr. Atkinson considered that the presence of the gas in the two places where he saw it was a breach of the Act. It would have been the duty of an overman to have stopped a man working in such a place. If the brattice were destroyed the ventilation would be gone altogether. In the north level he found the gas on the face near the roof. He had no idea of the quantity, but it was in the corner of the place, which was about 8 feet high, and the gas might be about 6½ feet high. He did not see any naked lights in the pit. If the gas he saw had exploded he would not have liked to have been near it. He considered that if there were sufficient air in the pit it would be presumptive evidence that the brattice was sufficient.

In opening the case for the defence, Mr. Lumb, jun., did not deny that gas was in the pit, but contended that the question was, was it there under ordinary circumstances? His witnesses would prove the affirmative, and that its similar accumulation could not be prevented in the best managed mines in England. That being so, he should confidently ask the bench to dismiss the case, as not being in contravention of the 10th section of the Act. The witnesses examined for the defence were Messrs. Postlethwaite, Lindow, and Thompson (directors of the company); Wm. Morris, the foreman deputy of the pit; Mr. George Dixon; John Lee, the overman; Mr. H. Mulcaster; and Mr. T. E. Forster. The only important evidence was that of Mr. Forster, who stated that on Dec. 18 he examined the colliery at Cleator Moor, at the request of the directors. Went into every working, and found every place free from gas. Did not consider Hope Pit a very fiery pit. On Wednesday last examined it with Mr. Dixon and Mr. Maddison. Travelled the return air-way from the face to the bottom of the up-cast shaft. Found no traces of gas. The quantity of air passing into the pit was 18,738 cubic feet per minute, and it had to ventilate from two to three acres of working. The ventilation was sufficient for all purposes whatever. There were 58 men and boys in the pit. At the point where the gas was found there had been a dike which produced it. If the gas had exploded it would not have caused the slightest damage. Indeed he would have set fire to it as the best way of getting rid of it. It was about 8 ft. high, and out of the way of a man. The pit could be worked with candles. He would have laughed at the Government Inspectors had he been with them, and they had talked of danger. The place where the second gas was found would be about two-thirds of a cubic foot. Made the calculation as to the ventilation with a little gunpowder smoke. Had no doubt the quantity of gas was what he had stated. The brattice was in a very good state.

After a brief cross-examination of Mr. Forster, which concluded by his recommending the pits to be worked as before, the bench declined to hear any further evidence, and dismissed the case.

THE INVENTOR'S INSTITUTE.

The first public meeting of the Inventor's Institute, to whose report we have already referred, was held in the theatre of the Polytechnic Institution, for the purpose of considering the working of the laws relating to Patents for Inventions, the measures to be taken in defending the rights of Inventors, and for general business. The chair was occupied by Sir EDWARD BELCHER, who opened the proceedings of the meeting by reading an elaborate statement pointing out the intended objects of the Institute, and the advantages which were likely to accrue to the inventor, to the public, and to the community at large from its operation. The existence of the Royal Society, the Institution of Civil Engineers, and the Society of Arts, each having objects somewhat similar to those of the Inventor's Institute, was alluded to; but he considered that there was ample room for their society, and that advantages would be derived from it which were not elsewhere to be obtained. He stated that they already numbered between 200 and 300 members, and that he hoped at no distant period they would have increased their number to 1000, when they would command a position which could not fail to give them influence.

Several members of the council, who are well known to the public as inventors, addressed the meeting, and detailed their experience of the working of the Patent Laws, and their views as to the rights of inventors and the privileges which ought to be granted to them. Dr. Normandy stated that, in his own case, he had patented a useful invention, and one which was ultimately proved to be such, yet such was the apathy of the public that it was nine years before he received back the money actually expended in securing the monopoly. He referred at some length to the article in the *Times* of Saturday last bearing upon the case of Clare v. the Queen, and maintained that the views expressed in that article were erroneous, and the arguments untenable. The writer of that article said that nothing but absolute and extraordinary novelties should be considered patentable, and what, he asked, were the examples quoted in support of this opinion? We are told that if the inventor discovers a new motive power, or if he discovers a new and useful metal that had not before been known, he was entitled to be rewarded, and so he was. But he would ask whether, if he discovered a new application of a well-known motive power, or if he discovered a new and cheap alloy, which could be used as a substitute for and possessed advantages over any known metal or alloy, was he not equally entitled to reward? At some time, no doubt, the discovery that power could be obtained from steam was new, and, therefore, the discoverer would have been entitled to a reward, even according to the *Times;* but he thought that if a man discovered an improved mode of using steam, whereby a greater effect could be produced at the same cost, he was equally entitled to reward. Was not the discoverer of superheated steam as much entitled to reward as the discoverer of steam itself? He maintained that the inventor did not ask for anything more than he was justly entitled to; he did not ask to deprive the public of any privilege which they previously possessed, but only that if he added to their comfort and convenience he should be paid for it. If a man preferred to eat his food off the grass with his fingers, and to drink his water out of the brook with his hand, the inventor did not want to prevent him doing so; but what the inventor asked was that, if he made a table, and a plate, and a knife and fork, he should be paid for the luxury of using them, and by those who preferred them to their fingers; or if he invented a crystal goblet, to be used instead of the palm of the hand, that he should, in like manner, be paid.

That there are many frivolous and useless inventions patented was readily admitted by several speakers; but it was contended that they were, nevertheless, frequently productive of benefit, either from their leading to the development of other and useful ideas, or from some other cause. Dr. Collyer thought the establishment of a committee of investigators would be very useful, and observed that, although America was at the present moment in an hour of trial, they might, nevertheless, look to her as an example of the advantage resulting from extending protection to inventors. What country, he would ask, had produced more new and useful inventions? Now, in America they have some preliminary examination, and he considered that much advantage resulted from it. The Inventor's Institute did not propose that there should be any prohibitory power placed in the hands of the investigators, but they proposed that there should be a body to whom the inventor could submit his invention, after "notice to proceed" had been given, in order to learn whether it, or any part of it, was new, and, if part was new and part old, that the old portions should be pointed out to the inventor, so as to enable him to amend his claims, so as to have a good and valuable patent. The committee of investigators is only to give its advice, leaving it to the option of the inventor to take it or not, as he thinks fit.

The members of the council having concluded their orations on behalf of the Institute, but little time was left for remarks from other parties; Mr. Paul Rapsey Hodge, and another inventor, who described himself as a working man, however, succeeded in addressing the meeting. Mr. Hodge considered that a committee of investigators would be advantageous, but thought that great care should be exercised in using the power thus placed in their hands. The other inventor thought it would be extremely dangerous to interfere with the present law, except, perhaps, to reduce the fees; there was, probably, as much intelligence in that theatre as could be concentrated in any room in the kingdom, yet he would be very sorry to submit any invention of his to the judgment of any committee which could be formed in that room, because the probability would be that, if it were extremely simple, every one of them would pass over its advantages—he would prefer to let every inventor depend upon himself, as at present, and was sure that it would be more to their advantage. It had been inferred by some of the gentlemen who had addressed the meeting that the alterations they proposed were to benefit the poor man, but he thought the result would be nothing of the kind. It was seldom that a poor man brought forward a useless invention, and there were always plenty to support useful inventions; but it was the man in better circumstances that brought forth worthless notions, in the hope of profiting by them, because they could avail themselves of their influence. It would be found that ten to one of the patents taken were by men of this class, and it was these men that did the real inventor injury. Mr. Hodge thought that the Inventor's Institute might prove useful as a check upon patent agents, and might prevent them, as in a case which had recently occurred, charging an inventor 15*l.* for a search which was never made, or made so carelessly as to be useless. The usual vote of thanks to the Chairman concluded the proceedings.

ROPE WHEELS FOR MINES.—An invention has been provisionally specified by Mr. Bryan Johnson, of Chester, the object of which is to afford the means of a ready adjustment of the length of the winding rope between the rope wheel and the cage, or article to which it is attached. On the shaft of the rope wheel he fixes a boss in two parts, each having a flange on the outside, so as to form between them a circular groove, into which is fitted the rope wheel in such manner that it may be turned upon the boss when required, and afterwards bolted to the side flanges by bolts. In the side flanges he drills in a circle of a given diameter a number of holes, and in the solid part of the rope wheel around the boss he drills in a circle of the same diameter, one, two, three, or more holes more than there are in the side flanges, so that the bolts employed for holding the wheel and boss together can be passed into different holes, and thereby obtain a very delicate adjustment of the length of the rope. Thus when there is one hole more in the rope wheel than in the flanges, if two bolts have been passed through two sets of holes opposite each other and then withdrawn, so that the rope wheel can be turned to allow them to be passed through the next set of holes the winding rope will be shortened a distance proportionate to a fractional part only of the circumferential distance between the holes, and if the wheel be turned to the next following set of holes another fractional part will be added, and so on the different numbers of the holes, producing an effect similar to the use of the vernier in philosophical instrument. When the boss consists of one part only the rope wheel is to be formed of two parts, in order to place it between the flanges, or the plan may be varied by having the wheel of one piece, and one of the flanges moveable.

MINERS' ASSOCIATION OF CORNWALL AND DEVON.

The address of Mr. Charles Fox at the Annual Meeting of the Miners' Association of Cornwall and Devon was particularly interesting, from the true business manner in which the various points are treated, and the care that he has taken not to lead to the expectation of more than can possibly be performed. He remarks that the year which has elapsed presents two strong grounds for increased exertion; one is the deficiency of their pecuniary means, the other is the large increase both in the districts in which the teachers labour and in the number of students. After listening to the official details on those two heads, it would be strange if they went home without fresh motives for vigorous action on the part of lords, adventurers, and miners, in giving their hearty co-operation and subscriptions to increase the income, which is not nearly so large as that which Sir Charles Lemon long ago so bounteously offered to settle on a mining school, and on the part of managers and other agents in assisting and stimulating the young miners. The mining school has been challenged to point out veins that would be productive; it has never professed to do so, but it can aid (as Capt. C. Thomas had observed) in leading inexperienced miners to distinguish where success is improbable. Capt. Tonkin writes that we may notice the marked difference presented by killas, elvan, granite, or porphyry in those districts where the mines are rich, compared with others where the mines are unproductive. Nor should they, continues Mr. Fox, neglect to observe how a lode may become changed in its productiveness when passing into another stratum, in itself more or less "genial" to deposits of ore. How noteworthy this is in the veins traversing the various rocks of the St. Just district, or the change to the fine-grained granite west of Lelant, in which the tin lodes and those fine carbonas are to be traced. Closely should the elvan courses be watched in their composition, dip, and direction, their vicinity so often apparently influencing the richness of a lode, as in Wheal Alfred and the Dolcoath district of mines. Again, the possible recurrence at a greater depth of a different rock in the mines north of Tuckingmill, as in East Pool (see Salmon's "Mining and Smelting Magazine") in which a north lode as soon as it is touched at the 140, the summit of an unlooked-for granite hill, became large and productive. Wheal Seton great course of ore in the killas seemed to have failed until the lode entered the hard greenstone (almost the matrix rock of ore in Dolcoath). Treavean plans show that the granite descends precipitously under the killas, barren there, but very rich on the eastern side of the granite hill of Carnmarth, where the electro-positive fluor-spar in vast quantities filled the western levels of those lodes, once so productive in Wheal Unity, whilst the electro-negative tin lay elsewhere. In the United Mines, in Wheal Music and Wheal Leisure, rich lodes or branches might be seen in the channels of the whitest killas. Let us observe how mineral veins seem to cluster round the granitic and elvanny isolated Cligga head, and round St. Agnes Beacon. And as we recede from the granite to the east of Chacewater Valley there are numerous lead veins, especially, as is so well known, in Newlyn parish, and in the clay-slates of the Looe Pool, Porthleven, and Liskeard districts. In the latter in south and north courses, in killas, half encircling the granite. Some of these lead-bearing cross-courses in Ludcott have produced much silver at the intersection of an east and west vein. In Herodsfoot a mere slide is the dividing line between the ore which is poor and that which is rich in silver. In the Caradon district, let the student note how the dark faces of the joints in the granite accompany there, as elsewhere, the rich copper lodes, nor neglect the strangy tinny capels of the singularly flat but rich Wheal Phœnix lode, or the enormous lode of West Sharp Tor and North Phœnix; in the latter mine having the granite on the foot and the slate on the hanging wall. Some 50 years ago his father, who was at that time more largely interested in mines than anyone else in the West of England, spoke of the probable abundance of ore around the Caradon hills, although the facts relative to our mineral veins were much less developed than at the present. The St. Austell district should be a whole volume of instruction to the young miner, if he will see for himself, and listen to the observations of Capts. Dally or Puckey, Williams or Barratt, who would point out to him its leading features, and how the parallel veins crossing a circular zone of killas (sometimes fossiliferous) are rich in copper, but as they enter the granite abound in the oxides of iron and tin.

After referring to the value of the researches of Faraday, Tyndall, Becquerel, Crosse, Moissenet, Jory Henwood, and others, Mr. Fox observed that, in conjunction with the late Lord de Dunstanville, some of them spent much on the lodes of Burncoose, Trejagewan, and Wheal Fanny (now consolidated in Carn Brea Mine), relying on the character and quantity of the gossan at that time supposed to be immediately over the ore, instead of being connected with it in abundance, as it was, on the east or west. Until of late years, when tin occurred under courses of copper it was but little wrought; recent experience shows how great may be its importance. Whenever such a coalition of the lords and adventurers in different setts may take place as may warrant their pursuing under the very long leases, the deepest and most extensive workings, for the simultaneous drawing and exploring of numerous adjacent lodes, productive at less depths, courses of copper may again be found below the tin. Alluding to the value of scientific knowledge to practical men, he pointed out the fact that the St. Dominic Company, near Callington, has succeeded in separating antimony of great purity from the lead, with which it is often found combined, and had hitherto been useless in Cornwall and Devon. Such mixed metals tax the highest skill of the metallurgist, as where 2¼ ozs. of copper per ton of lead gives a pink tinge to white lead; much of the Russian silver is obtained from the cupreous schists of Mansfeld and Eisleben. Such of our miners as may emigrate to Australia, will see that the gold when mixed with pyrites is very imperfectly separated. The large proportion of silver volatilised from a furnace, especially when with yet more volatile metals, as shown by J. Napier, jun., strengthens the conviction that the finer particles of tin are, although under different circumstances, often carried away in the draught of a calciner. Serpieri is an instance of the benefit which a thoughtful, observing man may confer on his country. He introduced into his native island, Sardinia, the smelting of ancient slags, which in 1860 produced 600 tons of lead, richer in silver than any yet raised from its modern mines. In like manner Captain Hunt obtained large results in silver from the rejected slimes near Rennes, in France. The novel application of a simple principle in his dressing machine is likely to benefit his country. Most of our lodes give in depth a less produce in silver, but in the deep mines of Bohemia and Saxony (several of which Mr. Fox had visited in both countries) the reverse is sometimes the case, galena from the 246 fm. level of the Przibram Mine in Bohemia, which is 300 fms. in depth, giving 300 ozs. per ton. Well content as we are with the skilful but routine mode of dressing, analysing, and smelting our principal produces, we must keep our eyes and ears open if we would return our poor ores profitably, and not let the cash fall down the shaft, and the metal be washed into the sea, or wasted in flues.

Attention was next drawn to the all-important subject of mining leases: Mr. Fox contended that they should be more simple in form; that impracticable conditions, such as the working of every branch, should be omitted; and that as a lease for 21 years of a mine worthy of costly and effectual working is far too short, some clause should be inserted for its renewal on fixed terms or equitable conditions. That there might be a covenant for an abatement of dues, whenever complete (and, therefore, safe) provision shall have been made for raising the miners when the workings have reached a specified depth. That the captains would kindly contribute their observations on the ordinary as well as the special characters of a part or the whole of a mine, or a group of mines, such as those already alluded to, and others, by the editor of Mr. H. C. Salmon's Magazine, in the "Bergzeitung," a most instructive periodical, or in the now indispensable *Mining Journal*. It is indisputable that if we knew all the geological and mineralogical appearances of every lode and cross-course yet explored in Cornwall and Devon, and all their mechanical relations, as well as those of the associated rocks, the law of probabilities, judiciously applied to lodes opened, would elicit conclusions approaching to certainty.

Referring to steel, he says that the great progress in its manufacture should be full of interest to us, as it is placed more within the reach of the engineer and miner. In the Carn Brea Mine Capt. Dawe is experimenting on steel stamps heads. If found to answer, they may be made partly of iron and partly of steel, as Mr. T. C. Burton has suggested. It is a practical point that iron, whether crystalloid or colloid (that is, like jelly), retains when liquified the characteristic properties of these states. Graham has found that crystalloids will pass through a membrane which obstructs a colloid. May not these different states of different minerals, such as silicon, have influenced their deposition in veins, &c.? A working man in Yorkshire has applied a machine in working a pick to cut coal, which is said to do the work of many men; cannot our engineers accomplish the more difficult task of striking the borer in holes for blasting?

But, perhaps, the most interesting portion of the entire speech is that in which Mr. Fox points out the means which each possesses of doing something in aid of general progress. Geological maps, he observes, and working plans of mines should be within the students' reach, which will aid them in arranging the facts they may observe, which, without method, are fruitful for others only. Let them record in writing their original observations, and from time to time test any conclusions formed. The least observing are the greatest guessers, the most speculative theorists; whilst the most accurate observer and the soundest inductive reasoner sums up his conclusions in few words, and carries them out with concentrated force. As Columbus, who eminently combined experience with theory, launched out into the deep but to him not illimitable sea, and found the new world; as Dalton, by his atomic theory, gave a new basis to chemistry; as Murchison laid bare the order of a mighty range of rocks, and decided that coal could not be found in a vast region of Russia; as Sedgwick, 30 years ago, pointed out the gap by which the untold, but then little developed, wealth of Durham would reach the sea coast; as Davy with one electric touch awoke from their sleep of countless ages those fiery gemi potassium and sodium, and thus by analogy threw light more wonderful than that of Aladdin's lamp on the matter composing our earth; as Hunt distinguished in the sun's rays those which are chemical; as Wheatstone measured in the vaults of Somerset House the speed of electricity through six miles of wire, to be sent through his telegraph to the ends of the world; as Trevithick and Vivian constructed that wonderful steam automaton which has made the pathway to Redruth Church classic ground to the end of time, as spouting fire it distanced them in the wondrous race; as Jenner, with the minutest drop of vacine on his lancet's point, has been the means of saving as many lives as the sword has destroyed in Europe since his discovery. Few can accomplish so much, but all can try, not neglecting small things, or overlooking small differences, when they occur to them.

THE CARBONIFEROUS ROCKS OF WESTMORELAND.—An interesting paper on the Carboniferous Rocks in the neighbourhood of Shap and Crosby-Ravensworth, by Mr. J. S. Bland, was read at the recent meeting of the Manchester Geological Society. The rocks under immediate consideration in the paper are a series of Lower Carboniferous or Mountain Limestone, located on the east side of the Lake Mountains in Westmoreland. Mr. Bland carefully describes the character of the formations about Shap Wells, and carefully notes the fossil remains which may be met with. He then considers the beds of limestone forming the Great Orton Scar strata. Shrinkage cracks extend deep into the strata in all directions, affording various crevices for the percolation of water; which in its turn washing in acids, wearing and dissolving continually widens these, and in lateral directions breaks open new ones, which through length of time become extensive caverns The only one at present known in these rocks is the Pate Hole at Asby; it is formed by a hard bed being superimposed upon a softer one; the latter has been worn away into a channel, about 8 ft. wide by from 3 to 12 ft. high; it has been explored upwards of half a mile, but beyond that deep water forms a barrier. No cavernous remains have been found in it, and probably, from being subject to sudden and frequent outpourings of water, it may never have been the resort of animals. It is, no doubt, supplied by the water sinking into the crevices on the high grounds; this sinking is also the cause of what are called Pot Holes, occuring on all limestone lands, the water causing in its downward course a sinking of the earth into circular cavities. There is another set of fissures at Asby Scar, containing copper ore; these veins may be traced in some places along the surface. They were at one time worked, but either from want of enterprise or sufficient returns, were abandoned. A marble mill was also set to work, but with like success; some of the stone when cut and polished presents a beautiful mottled surface of a slightly red colour. In other formations of the same rock, small cracks have, by the percolation of water, often become soldered up by the crystallisation of carbonate of lime. On forcing these open again large specks of lead ore are sometimes found, a fact which, in part, may support the theory of lead being a deposit of crystallisation from water. The sandstone next in order is then referred to, and next the red coloured limestones. Having given the characteristic features of each rock in the order of its deposit, Mr. Bland concludes by giving an outline of the position they occupy, and the forces which have been at work. In the discussion which followed the reading of the paper, Mr. Peter Spence remarked that it was the first time that he had heard of copper being worked in the district.—Mr. Dickinson said that copper was not found there to any large amount, the deposit was chiefly lead. Zinc sometimes accompanied the lead, but was seldom found sufficiently valuable to be exclusively mined for. Some years ago a zinc company was formed, but it entailed a very large loss upon the proprietors.—Mr. Binney said that near Melberby there had been one or two mining trials, and the results rather damped the energies of those who undertook them.

UTILISATION OF WASTE PRODUCTS IN THE MANUFACTURE OF IRON.

An invention has recently been patented for Messrs. Minary and Soudry, of Paris, according to which it is proposed to treat and utilise the slag and scoriæ from the puddling or other furnaces employed for manufacturing or refining iron, and in re-heating or melting the heads, gyts, and waste top pieces of cylinders, or other castings; the waste metal worked from squeezers, shinglers, &c., employed in the manufacture of iron, together with the treatment of waste or refuse metal generally, which usually contain from 40 to 70 per cent. of iron. It is stated that 1 ton of scoriæ prepared as hereafter described produces about ½ ton of iron when introduced into the smelting furnace in the proportion of about 15 to 20 per cent. of the mineral to be fused, and it is smelted without any increase in the quantity of fuel employed for the reduction of the mineral, by which an increase of about 30 per cent. of metal is obtained. Thus 1 ton of scoriæ, costing about 5*s.* in preparation, produces about ½ ton of cast-iron of good quality, which puddles easily, being equal, if not superior, to that obtained from the best iron prepared from coke. Iron so manufactured is found to work well either hot or cold.

Hitherto it has been usual to extract a portion only of this refuse metal by treating the materials containing it as minerals, and throwing them into the blast furnace again without submitting them to any other process, except breaking up into smaller pieces to render them suitable for re-smelting. The quantity of these refuse materials which can be thus employed is very small, owing to the injury which such materials are liable to cause to the iron with which they are smelted; consequently the bulk of such refuse materials is usually thrown upon the slag heap, or employed for repairing roads, or for other like purposes. The means employed by Messrs. Minary and Soudry for utilising the whole of these materials are exceedingly simple and inexpensive, and consist of two operations—first, in pulverising them by means of edge runners, stampers, or other mechanical means; and, secondly, in their carburation previous to their introduction into the blast furnace; this process being effected without cost of fuel. For this purpose the slag and scoriæ obtained from puddling and reheating furnaces are thrown whilst in a melting or red-hot state into cold water, in order to render them brittle and friable (buts gyts or other waste metal does not require this treatment). The slag and scoriæ thus prepared are then ground or reduced to small particles and exposed to the air, in order to free them from the sulphur. After exposure to the air for a suitable time, depending on the quantity of sulphur contained therein, they are dried and reduced to powder by edge runners, stampers, or otherwise, and then sifted. The pulverised materials are then combined with coal, such as is used for making coke, and charged into a coke oven or furnace, and carbonised in the ordinary manner.

It is found in practice that as much as 70 per cent. of scoriæ may be combined with 30 per cent. of rich coal, which mixture will make a coke sufficiently hard to bear the action of the blast-furnace. The coke thus obtained will contain globules of cast-iron disseminated throughout its entire mass, which will have been reduced and carbonised by the fuel employed for making the coke, especially with the hydro-carbons which are disengaged during the process. The reduction of the minerals will thus be found to result from the gases which are evolved during the carbonisation, the quantity of gas produced being in excess of that required to effect the reduction of the metal, besides being of a proper temperature for this purpose, thereby utilising the heat and gases, which have hitherto been completely lost in the operation of coking. The ground scoriæ, mixed with a small proportion of coal sufficient to reduce it to a metallic state (which for scoriæ containing about 50 per cent. of iron would be about 10 or 12 parts of coal to 100 parts of scoriæ), may be thrown into the same coke oven or furnace after several burnings (of the previously-described proportions of these materials) have taken place—that is, when the furnace is in a highly heated state, by which these materials will be reduced, and produce an excellent element of affinity wherewith to form the beds of puddling furnaces in place of using the ordinary materials. The same processes are also suitable for treating richer minerals or materials than those before referred to. Fluxes or other materials may, if desired, be added to the mixture of scoriæ and carbonaceous fuel for the elimination of the metalloids previous to their introduction into the blast-furnaces.

NEW GUN METAL.—The researches of Capt. Caron in connection with the composition and manufacture of steel are already well known; he has now prepared for the Minister of War a report, which contains some facts entirely new, and likely to be useful both to the metallurgical and the commercial world. He tells us that there is one kind of steel on which the introduction of reduced wolfram has a peculiar influence; it is soft cast-steel. This steel having necessarily, on account of its qualities, a daily employment for artillery as well as for commercial purposes, Capt. Caron has entered into details respecting it, which we partly reproduce. More than 12 months since samples of a peculiar soft steel were brought to the artillery factories, and the remarkable qualities of this metal induced Col. Trielle de Beaulieu, the director, to apply it to the manufacture of tubes intended to protect the copper of the points of sight of heavy ordnance. This steel has the property of drawing cold, in tubes of any dimensions, and, after drawing—above all, if the metal be tempered—the grain, perfectly homogeneous, is fine and watered, the steel has become strengthened (nerveux), and offers an extraordinary amount of resistance. Since then gun barrels, manufactured from the same material, have been presented to the factory for the models of arms, and Capt. Maldin, director of this establishment, struck by the beauty of the metal, thought it his duty to try the barrels in order to establish their quality. A gun barrel of the ordinary dimensions of a sporting gun was severely tested. A charge of 2 ozs. of fine Esquerdes powder (the most destructive powder known) produced no effect, nor did 5 ozs. of ordinary gunpowder. In the last experiment tried 150 grammes (5 ozs.) of powder and five balls were employed, the latter weighing together 135 grammes (say 4½ ozs.), well rammed home. The only injury seen was a swelling in the barrel at the spot where each of the balls was placed, but the barrel was not burst, not even cracked. If it be considered that the charge of powder was already 23 in. long, and that a more considerable quantity would not have had time to burn entirely, it may be fearlessly concluded from these experiments that the metal employed in the manufacture of these barrels is capable of giving arms which cannot be burst by the effort of any charge of powder whatever.

INTERNATIONAL PRIZE MEDAL—SIGNAL TELEGRAPH.—In referring to the United States department of the International Exhibition we mentioned the very ingenious system of night signals for marine purposes, exhibited by Mr. W. H. Ward, of Auburn, New York, and felt bound to notice the extreme simplicity of the arrangement, and we have now before us the seventh edition of his illustrated description of his invention, which we have no hesitation in commending to all connected with maritime affairs. The importance of the invention may be judged of, when it is stated that by the night arrangement upwards of sixty messages have been telegraphed and respectively answered in less than one hour by the numerical system, at a cost for light not exceeding 4*d.* for both stations. In the present edition an entirely new system of gun fog-signals is also described, the great advantage of which we conceive to be that it will be almost impossible to misunderstand them, and that they can be made by ships carrying only a single gun, and even allowing that occasionally to misfire.

PURIFICATION OF COAL GAS.—According to the invention of Mr. Arthur Warner, of Threadneedle-street, it is proposed to employ in the purification of coal gas the cinders or oxide of iron obtained from puddling, reheating, and refining furnaces used in the manufacture of iron. And in order to prepare the materials they are stamped fine and passed through a sieve with holes an eighth of an inch square. Heretofore the hydrated oxides of iron, which have been used for purifying coal gas, have been peculiarly useful, and Mr. Warner has ascertained by extensive experiments that by the use of the cinders or oxide of iron above mentioned, when properly prepared, not only is the sulphuretted hydrogen removed but the carbonic acid and ammonia. If the cinders or oxides have much dirt or impurities mixed therewith it is desirable that the same should be washed out before the cinders are used. The sifted oxide is used in what are called dry lime purifiers, or those wherein other oxides of iron are used, and in like manner thereto, and such cinder or oxide is generally used in a damped state, but this is not essential. It is found that when the cinder or oxide of iron obtained from the furnaces of ironworks, as above mentioned, is used for the first time to purify coal gas, the sulphuretted hydrogen is not so fully and effectually acted on as when using hydrated oxide of iron, such as is now very largely employed, and it is only when the cinder or oxide from the furnaces of ironworks has been further prepared that it fully and effectually acts on the sulphuretted hydrogen of the coal gas, which is being purified thereby; hence it is desirable when using a quantity of such cinder or oxide for the first time to combine it with a quantity of other like cinder or oxide which has been before used, and which has been subsequently further prepared by the action of atmospheric air. After the cinder or oxide above mentioned has been used for a time, and the power of purifying gas has become no longer sufficient for the purpose, the cinder or oxide is removed from the purifiers, and made up into heaps in the open air till the same becomes heated, when the cinder or oxide is to be spread and turned over from time to time, till it becomes again suitable for use, which will generally be the case in a few days, depending on the state of the atmosphere. Mr. Warner makes no claim separately to this system of revivifying oxides of iron by atmospheric air after they have been used to purify coal gas, as the same is well known when treating other oxides, but it is new thus to treat cinders or oxides of iron from the furnaces of ironworks, and thus to prepare such cinders and oxides of iron for the purification of coal gas. The cinders or oxides of iron obtained from the furnaces of ironworks, thus prepared, not only retain the property of removing carbonic acid and ammonia, which they are found to possess when used in the first instance, but they are rendered more effective in removing also the sulphuretted hydrogen from coal gas.

ROLLING WIRE AND OTHER RODS.—As an improvement upon the ordinary mode of rolling wire and other rods of metal, Mr. George Bedson, of Manchester, proposes to employ rolls placed at various angles, and in a series of guides for conducting the bar from one pair of rolls to the other. By this means the original bar is drawn down to the requisite size without handling at all.

TEXTURE OF COPPER.—M. U. Vivian showed last year that manufactured copper always has a porous and cellular texture, whilst native copper is always crystalline. Now he proves that the native copper from Lake Superior is neither crystalline nor cellular, but dense, ductile, and fibrous, as though it had been violently compressed when cold. When melted it, however, takes the structure of all manufactured copper.—*Cosmos.*

ST. JUST CONSOLS MINING COMPANY (LIMITED),

IN THE PARISH OF ST. JUST, NEAR PENZANCE, IN THE COUNTY OF CORNWALL.

Incorporated under the Joint-Stock Companies Act, 1862.

Capital £6000, in 6000 shares of £1 each. Deposit on application 5s., and 5s. on allotment. No further calls to be made for twelve months.

DIRECTORS.

EDWARD W. BURLS, Esq., the Villas, Erith.
HENRY L. PHILLIPS, Esq., 8, London-street, Fenchurch-street, London.
DAVID GRIMMETT, Esq., 2, King's-row, Walworth, London.
JOHN WARD, Esq. (firm of Ward Brothers), 56, Bartholomew-close, and Islington, London.
WILLIAM C. PAUL, Esq., 56, Queen's-road, Bayswater, London.
(With power to add to their number).
} Directors of the Crowan Consols.

BANKERS—Robarts, Lubbock, and Co., 15, Lombard-street, London; Batten, Carne, and Marrack, Penzance, Cornwall.

MANAGING AGENT—Capt. John Carthew.

PURSER—Mr. William Angwin.

AUDITOR—Charles Warwick, Esq., 25, Bucklersbury, London, E.C.

SECRETARY—Mr. Thomas Carthew.

OFFICES,—4, BARGE YARD, BUCKLERSBURY, E.C.

This company is established for purchasing and working the extensive and valuable tin mines called the St. Just Consols, in the parish of St. Just, near Penzance, Cornwall, and situate in a district which is one of the most productive in the county, and has become distinguished by the rich returns and profitable results of mining operations carried on within it. The undermentioned mines, which are producing immense quantities of tin ores, and continue paying large dividends to the shareholders, are immediately adjoining and contiguous to the one under notice.

Names of mines working, paying dividends.	Shares.	Amount paid per share.	Original outlay.	Dividends paid per share.	Total amount of dividends.	Present market value.
Levant Mine..	160	£ 2 10 0	£ 400 0 0	£1091 0 0	£174,560 0 0	£16,000 0 0*
Botallack Mine	200	91 5 0	18,250 0 0	455 15 0	91,150 0 0	50,000 0 0*
Wheal Owies..	80	70 0 0	5,600 0 0	310 13 0	24,852 0 0	26,000 0 0*
Boscean Mine..	240	20 10 0	4,920 0 0	36 10 0	8,760 0 0	14,400 0 0*
Spearne Moor..	280	31 17 9	7,168 0 0	9 15 0	2,730 0 0	12,650 0 0*
Total			£36,338 0 0		£302,052 0 0	119,050 0 0

* Geological position, decomposed granite, slate, and greenstone.

The above five mines, on an outlay of £36,338 on the present working, have already paid back in dividends to the shareholders £302,052, and the market value stands at £119,050.

As the before-mentioned mines stand prominent in the Dividend-paying List, it may not be out of place to state also that Botallack Mine has given back to the shareholders in its former workings upwards of £250,000; Boscaswell Downs Mine upwards of £49,000, and again resumed working by a new company; Wheal Cunning upwards of £25,000; Boscean Mine upwards of £15,000; and Spearne Consols, for an outlay of £1280 upwards of £10,000; thus making a total sum five mines have paid back in dividends to shareholders of £34,000.

PROGRESSIVE MINES.

Names of mines working.	Shs.	Outlay.	Market value.	Geological position.
Pendeen Consols..	5000	£19,250 0 0	£30,000 0 0	Decomposed Granite, slate, and greenstone.
Boscaswell Downs	1248	8,424 0 0	13,104 0 0	Granite.
Balleswidden	1624	19,082 0 0	19,488 0 0	Granite.
Boswedden	123	3,936 0 0	3,936 0 0	Granite, slate, and greenstone.
Bosorn	160	1,040 0 0	1,680 0 0	Granite.
St. Just United ..	6000	10,500 0 0	21,000 0 0	Granite, slate, and greenstone.
Total		£62,232 0 0	£89,208 0 0	

The setts are very extensive on the course of the lodes, and have been granted to the proprietors at the very moderate royalty of 1-24th dues for the term of 21 years, and on the usual mining conditions. Ten rich tin lodes, as well as cross-courses (or guides) pass through this mineral ground. All of these lodes have been wrought on, and, so far as they have been opened, have proved very productive, and will, at deeper levels, prove rich and more lasting in their downward courses. This, in fact, has actually been the result in every mine in the districts.

The geological position of this extensive and valuable mining property cannot be surpassed in the county. It is in beautiful strata, quite congenial for producing tin in the granite, precisely of the same character as Botallack, Levant, Boscean, Balleswidden, and other mines in the district.

These mines lie immediately adjacent to the rich Botallack, Levant, and other mines, all making large dividends, and producing tin in the granite. All these mines exist under such geological parallels, that it is almost impossible to overlook the fact that they cannot fail under good management to become highly profitable; so much so, that in a long catalogue of all the surrounding mines not one but has proved a most excellent investment for capital.

There is an immense field of tin ground, containing ten lodes, in the grant. These have been partially worked to about 24 fms. deep; affording evidence that there remains an unlimited supply below, which may be worked to extraordinary profits under the favourable circumstances of the prevailing high prices of tin, low prices of mining materials, and the access of ample water-power.

There can be no doubt that this property is actually teeming with certain and abundant mineral wealth, as it is the decided opinion of persons competent to speak on this mine, that when it shall have been set to work, the profits that will accrue therefrom will place it in a position second to none in the district for the outlay.

The directors, after an unusually rigid enquiry and careful inspection of these mines, have the greatest confidence in bringing this property before the public, and they feel satisfied, by established facts, that a more promising and advantageous investment, and one more free from any speculative feature, has never before been offered to the public.

The capital of the company will consist of £6000 in 6000 shares of £1 each. Deposit 5s. per share on application, and 5s. per share on allotment. No calls to be made until the annual meeting. The conditions of purchase of this valuable mining property are 2200 fully paid-up shares, no cash being required, thus proving the vendor's confidence in the success of this undertaking; although he has been working the property for a very considerable time at his sole expense.

The company having been registered, with limited liability, no shareholder can, under any circumstances whatever, be made responsible for a greater amount than that of the shares to which he subscribes.

There are no special Articles of Association; Table A, under the Companies Act, 1862, having been adopted in its entirety, except clause 37, which has been altered so as to ensure the attendance of a sufficient number of shareholders to enable business to be transacted at the meetings of the company.

To insure subscribers from any loss, which often ensues when a sufficient number of shares are not applied for, the directors bind themselves to return the whole of the deposit money, unless at least one-half of the shares are subscribed for.

A considerable portion of the capital has been already subscribed, and the directors will proceed to allot the shares as soon as they deem the requisite number applied for.

It is unnecessary to enter into further particulars in the prospectus, as the annexed reports of mining engineers and practical agents of the highest standing in the district, who have inspected these mines, will sufficiently corroborate the statements herewith submitted.

Some fine specimens of the tin ores from the various lodes may be seen at the offices.

Prospectuses, plans, forms of application for shares, and any other information may be obtained of the secretary at the offices of the company.

REPORTS.

Marazion, Nov. 24, 1862.—Herewith be pleased to receive report of the above-named mines. These mines are situated about three miles north of the Land's End, Cornwall, and extend westward under the sea to an unlimited extent, and eastward from the sea 500 fms. The sett is very extensive, and contains a great number of well known strong tin lodes, which have been very productive in the adjoining mines. In the granite the channel of ground is similar to the mines to the north, Wheal Owles, Botallack, Levant, and Pendeen Consols Mines; these mines at the present time are making very good profits, and producing large quantities of first-rate tin, which is near the cliff. In St. Just parish several of these lodes have produced tin near the surface; not one of these lodes have been proved more than a few feet below. I consider this sett to be in a good situation, and a first-rate run of tin lodes that are likely to produce large quantities of tin for a number of years to come. I have just made a trial on two of these lodes; one about 16 fms. below the surface, and here I find a good run of tin ground discovered; on the other lode I find the shaft only sunk about 2 fms. from surface, lode 3 ft. wide, worth all of £15 per fm. for the length of shaft. The principal point is to get the stamps at once, and then this mine will at once pay cost, and at the same time be improving the other lodes, and in a few months send tin to market. I would recommend a 30-ft. wheel, as there is sufficient water-power, and at the same time be getting the floors ready for the dressing of tin, &c. In conclusion, I beg to say in taking a general view, therefore, of this mine, and looking at the position and the number of lodes, together with the congenial character of the country, there can be little doubt but that a small outlay will place this mine in a very profitable position. PETER FLOYD.

Report of Capt. CARTHEW who was formerly the principal officer of the Bolivar Mining Association, Venezuela, South America; managing agent of Balleswidden, Parkanoweth; Pendeen Consols, Boscean; Spearne Consols, Carnyorth; and now St. Just United:—

St. Just, near Penzance.—These valuable mines, which you have so fortunately secured, are situated in the parish of St. Just, about three miles north of the Land's End, and seven miles from Penzance, in the county of Cornwall. The sett is very extensive, being upwards of a mile in length on the course of the lodes, and 400 fms. wide, and traversed by ten well-defined and known rich tin lodes, bearing north by west and south by east in the granite, besides a good number of caunter lodes, with various branches and veins of tin running from one lode to another, and so far as they have been opened have proved very productive, and will no doubt at deeper levels prove richer and lasting in their downward courses, which has been the case of every mine in this district. The deep adit level has been extended a great number of fathoms on one lode in excellent tin ground. There is a shaft now sinking on another lode in a good course of tin, 2 ft. wide, and only 4 fms. from surface. The geological position of this valuable mining property cannot be surpassed in the country; it is situated in beautiful strata, quite congenial for producing tin in the granite. One great recommendation is, there will be no steam-engine wanted for drawing the water for years to come; as there are ample backs to work, and water passing through the sett, which will be available for draining the mines, as well as for stamping all the tinstuff. I consider that within 12 months after operations have fairly been commenced on the mines, two water-wheels erected, and dressing-floors laid out, the company will be in a position to return tin, and be paying regular dividends. Having been a managing agent, at home and abroad, now upwards of 44 years, I feel proud in recommending these mines to your notice, and I can with confidence say, for a small amount of capital required, there is nothing like them again; and looking at the sett throughout, and duly considering every point connected with it, I cannot come to any other conclusion than that you possess a most valuable mining property.

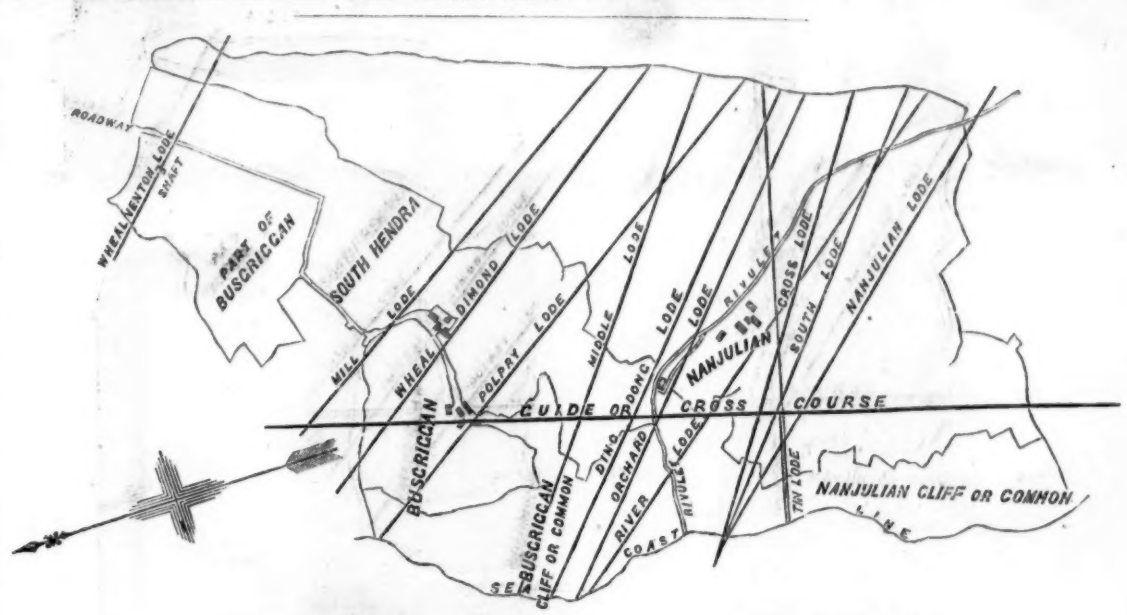
JOHN CARTHEW.

Report of Capt. RICHARD WEARNE, formerly of Wheal Fowl, now at St. Just United:—

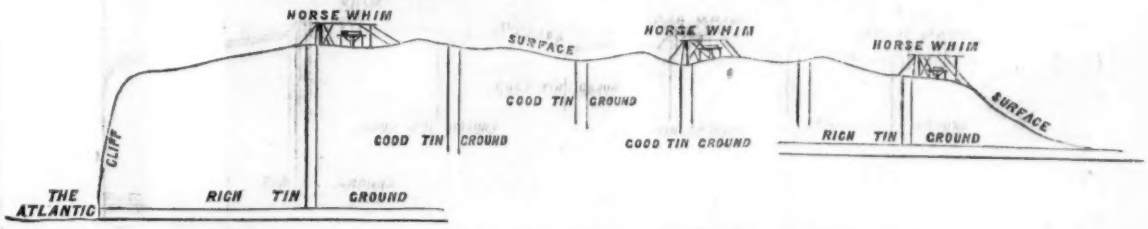
St. Just United.—In handing you my report of the St. Just Consols Tin Mines beg to say I have been over the sett of the same three times, and have taken particular notice of the different lodes throughout. One great recommendation in favour of this property is that all the lodes are running parallel with the rich tin-bearing lodes in St. Just United, Wheal Owles, Botallack, Levant, Boscaswell, and Pendeen Consols, and precisely the same channel of tin ground. The lodes are large, and not one of them have yet been worked below the sea level. I consider you have a valuable mining property, as a quantity of rich tinstuff is now being raised, only a few feet deep. My advice to you would be to get a water-wheel erected immediately, and stamp your tinstuff now raising; you can return a good quantity monthly, as you have a deal of good tin ground laid open, and you can break a good deal of tin only 30 ft. below surface. I do not hesitate in saying no other mine in this parish can do the same; besides, the lodes are near the cliff. Also, your miners have recently discovered a rich tin lode in the north part of your sett. They have commenced sinking a shaft 8 ft. long; the lode is 2 ft. wide, only 24 ft. from surface, with rich stones of tin. I consider this lode is worth upwards of £10 per fm. On the whole; the mines are very valuable, and I feel great pleasure in recommending this property as most *bona fide*, and I shall take an interest in the same, as I believe it cannot be equalled in Cornwall for the outlay, and it will not be long before it will be paying good dividends. RICHARD WEARNE.

Report of the St. Just Consols Mine, Parish of St. Just, Cornwall, by GEORGE HENWOOD, Esq., F.G.S.:—

Nov. 15, 1862.—These mines are situated on the southern part of this highly favoured mining district; in this parish are some of the richest of the Cornish tin mines, without exception it may be pronounced the richest mineral depository for its extent to be found in Cornwall. The following mines being all within a few fathoms of or adjoining each other:—Boscaswell Downs on the North, with Pendeen Consols, Levant, Botallack, Spearne Moor, Spearne Consols, Carynorth, Wheal Owles, Boscean, and Balleswidden, all of which have paid enormous dividends, and have proved deep and lasting mines. More recently the St. Just United Mines, in close proximity to St. Just Consols sett, have been re-worked with most signal success, the present price of tin being highly remunerative, and the tin of St. Just being generally of the best quality. The strata are granites and porphyries in close neighbourhood of the killas, or clay-slate, therefore admirably situated for metallic veins, especially tin lodes, several of which are known to exist, and are to be readily traced in the cliffs. The St. Just United Mines have the advantage of proof positive that tin ore in large quantities is easily and cheaply procurable, skilled mining labour abundant, a ready market close at hand, and above all, at very moderate dues—viz, 1-24th, with a lease for 21 years. Having known the district, as well as the sett, from my boyhood, I can unhesitatingly say a more promising piece of ground is not to be found in West Cornwall, and I confidently advise vigorous measures for its development, and I think your capital ample for the purpose, and wish you the success no doubt you will early achieve.



LONGITUDINAL SECTION OF DING DONG LODE IN ST. JUST CONSOLS TIN MINE.



This mineral property is situated south of St. Just United, and in a district which is known to be the most productive tin parish in the county. The sett is very extensive, and contains several rich tin lodes, as well as cross-courses. The nature and quality of the stuff already raised warrants this to be a splendid undertaking, and one that cannot fail from presenting indications of speedily becoming a regular dividend-paying mine. No steam-engine will be required for years to come, as a powerful stream of water, amply sufficient for all requirements, runs through the sett, and can easily be made available. A water-wheel, of 24 ft. diameter and 24 in. breast, with axle, eight heads, lifters, grinders, stamp and cover-plates, are ordered, and to be erected without delay. Several gentlemen of high repute and standing in the neighbourhood have already applied for shares, knowing the locality, and more, especially, of this valuable property. They have agreed a more promising undertaking was never before the public. The mine is divided into 6000 shares, and only 5s. per share on application and 5s. per share on allotment. No further calls for 12 months, and it is confidently expected that no call will be required after the allotment.

FOREIGN MINING AND METALLURGY.

It is stated with respect to the Belgian coal trade that in the basin of the Centre quite so ready a demand has not been experienced of late from small consumers, but the deliveries made to ironworks and blast-furnaces are well maintained, rich coal being dispatched in larger quantities than in November or December. The cokes of the Centre also find an advantageous outlet by the Luxembourg Railway for the blast-furnaces of the Moselle, orders for upwards of 1000 tons, to be furnished within a brief period, having been received from that direction. The coal workers of the Mons basin are about to form a union among themselves, and at a meeting which they held recently they resolved unanimously that it was desirable to arrive at an understanding as regards the quantities of coal to be extracted, and the sale prices, which, it appears, will not be changed. In addition to the contracts for rails recapitulated last week in the *Mining Journal* as having been obtained by Belgian works, we may now note that several others have been since concluded. The most important is an order for 25,000 tons of rails, and 30 locomotives received by the Syndicate of Belgian works through Messrs. Parent, Schaken, and Co., for the new South Italian Railway Company. The General Railway Plant Company of Belgium has obtained a contract for the supply of the fixed and rolling stock required for a small Italian line—that from Bra to Cavallermaggiore. This order was secured some weeks since, and the General Railway Plant Company has now sub-let 6000 tons of rails to the Monceau and Seraing works. To the summary given last week of the various contracts for rails signed during the last three months an addition of 31,000 tons may now be made; and Belgian works have now to deliver, within rather a brief period, about 100,000 tons of rails. The various rolling establishments are thus assured work for some little time; prices are hardening, and at present it would be impossible to obtain rails below 6*l.* per ton. This rate will be maintained all the more easily, seeing that guaranteed rails cannot be purchased in England at less than 6*l.* per ton—that is the same price as in Belgium; and when they can contend on equal conditions with England, Belgian industrials do not complain, as their products are, they affirm, pretty certain to command a preference, in consideration of their excellent quality. An adjudication for 2000 tons of plates and irons has just taken place at Amsterdam, and Belgian works were victorious on the occasion. The Couillet Company obtained the contract, although it had to struggle against the Sclessin and Ougrée works, as well as 16 English industrials. The plates and irons contracted for are to be employed in the construction of a floating dock which the Dutch Government has undertaken, for the accommodation of its possessions in the East Indies. Couillet has also obtained a contract for the construction of eight locomotives for the East Belgian Railway, and several contracts have, besides, been concluded of late on French account, for plates for maritime constructions, bridges, and boilers. All these various orders have had the natural effect of communicating great firmness to prices, and some rolling works have advanced the rate for merchants' irons 4s. per ton, having now established quotations at 6*l.* 8s. per ton.

The Société Anonyme des Charbonnages de Falnuée has just declared a dividend of 12s. 6d. per share on account of the second half of 1862. The Société de Niederfischbach has issued the annexed statement of its operations for the last quarter of 1862:—The Concordia Mine yielded 205½ tons of rough plombiferous minerals; the Zeus Mine, 723¼ tons of the same minerals; the Wusteifen Mine, 152 tons of the same description of minerals; the Fischbackerwerk Mine, 78 tons of the same description of minerals: and the Roter-Adler Mine, 170½ tons of prepared iron minerals; making a total of 1328¾ tons. Nearly 318¼ tons of lead were produced in the company's reduction furnaces in the same period; and the works delivered to commerce 278 tons of refined lead, 22½ tons of litharge, and about 600 lbs. of fine silver.

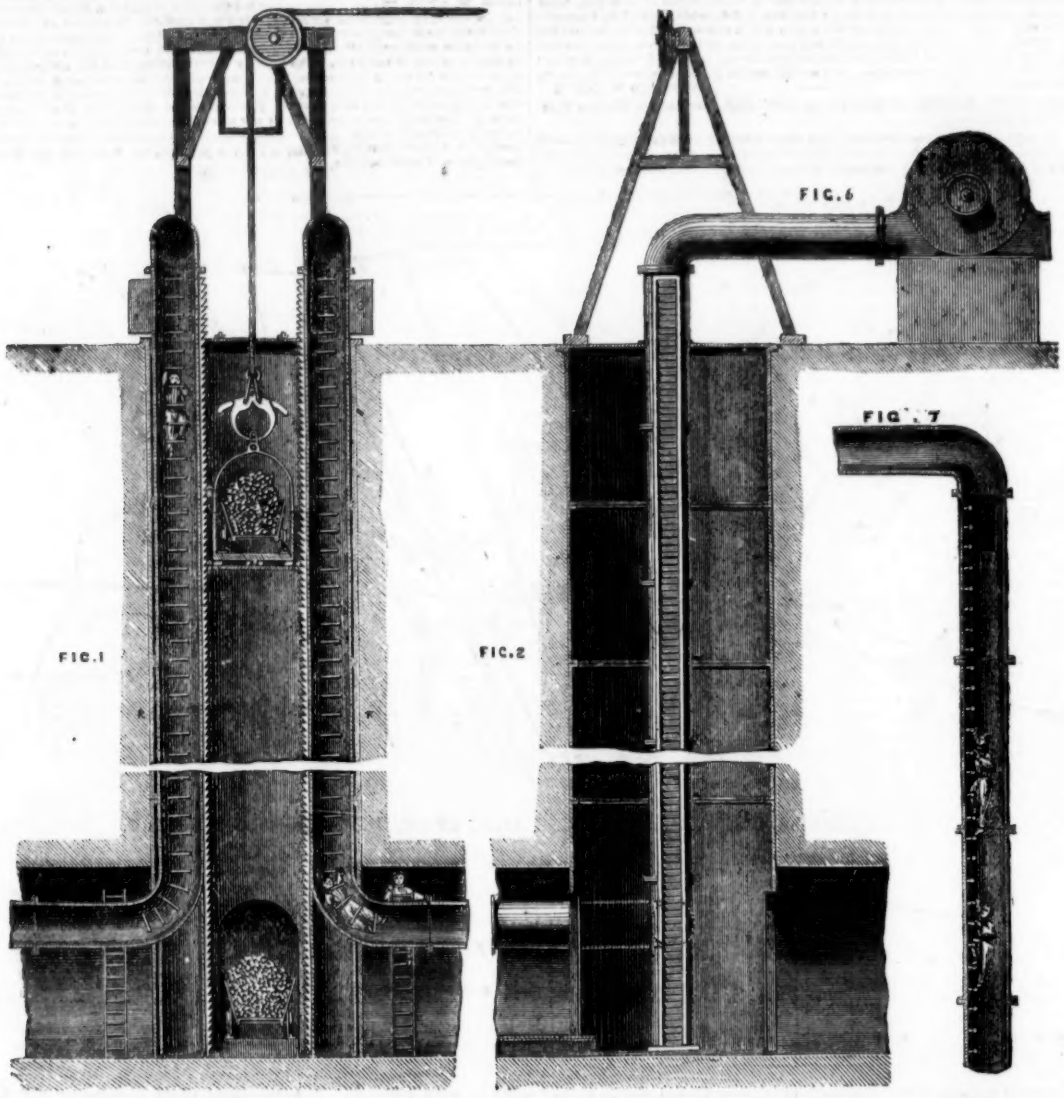
In the Haute-Marne (France) pig continues to fall, and it could not preserve its prices, even at their present point, but for the shortness of disposable supplies. Refined pig is offered at 5*l.* 10s. per ton, delivered at the St. Dizier or Joinville stations. In mixed pig there is but little doing. Prices of iron remain without change, the works maintaining their activity. Quotations for chains are falling. The Nouvelle Blast-Furnace Company has just lighted its two blast-furnaces in the department of the Aude; this establishment produces with wood steel pig of very good quality, which will find an easy outlet in the fabrication of puddled and cast steels, as well as hard steel irons. Steel industry is likely to attain large proportions in France; experiments have been made with several new systems of fabrication, and the results obtained give the certainty that the problem of the economic production of steel will be very shortly solved. An establishment to be specially devoted to this industry has just been started, under the management of a company styled the "Société des Aciéries d'Imphy St. Seurin." The new undertaking comprises the Imphy works, detached from the concern of the great Fourchambault Company, and the establishments of Mr. Jackson, at St. Seurin-Sur-l'Isle. The Bessemer process will be carried out at these works. The new Treaty of Commerce concluded between France and Switzerland will materially reduce the import duties levied by the Helvetic Confederation upon foreign irons, and as a consequence of this the construction of new foundries in the department of the Doubs, in the immediate neighbourhood of the Swiss frontier, is already spoken of.

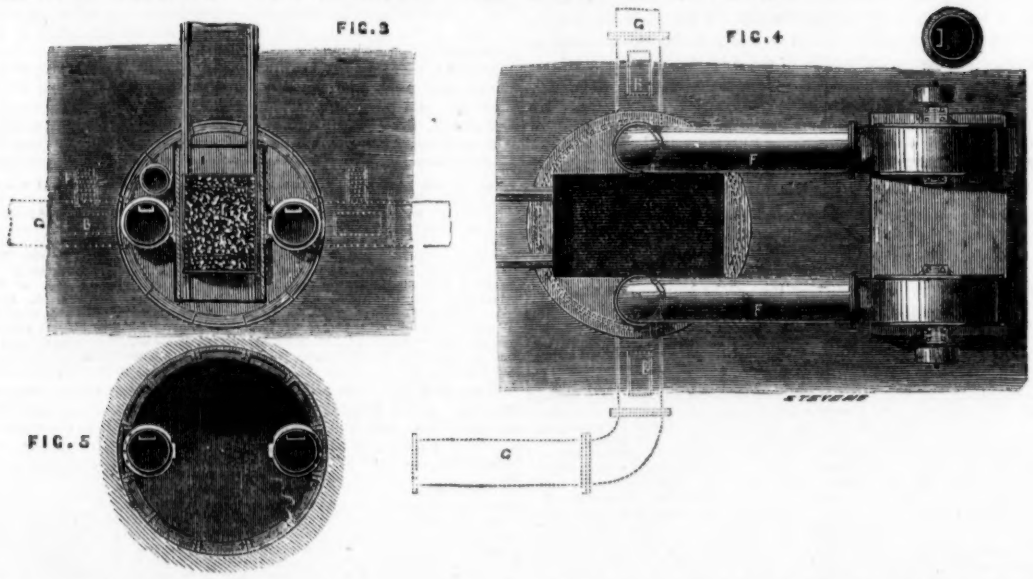
English copper has been a good deal sought after at Paris, in consequence of the fall in prices. English in plates has been quoted 89*l.*, and United States, Lake Superior, 106*l.* 8s.; Chilian has scarcely found buyers at 86*l.* 10s. Toka is quoted 92*l.*, and Spanish 88*l.*; old red copper 88*l.*, and rolled red copper 102*l.* per ton. Berlin and Cologne have been calm, and without much business. The demand has been very animated on the Hamburg market, but in consequence of the limited stock not much business has been done. As regards tin, there has been very great animation on the markets of Amsterdam and Rotterdam, and some important transactions have been concluded at prices ranging from 70 fl. to 71 fl.; at Rotterdam one lot of 1000 blocks brought 73 fl. There has been a slight rise at Paris. Banca having been dealt in at 123*l.*, and Detroit at the same price. English has been calm, at 116*l.* per ton. At Marseilles, Banca has been quoted 120*l.*, and English 120*l.* per ton. Hamburg has been quiet, and only a few transactions have taken place, at previous rates. Berlin has been firm; Cologne and Stettin without variation. The Paris lead market has been very firm, rough French being quoted 22*l.*, and Spanish 22*l.* 8s. per ton. Stolberg maintains itself without variation at 11¾ fl., at Rotterdam. Lead in saumons, first fusion, has been quoted at Rotterdam at 19*l.* 6s. per ton. At Hamburg prices have been sustained, but the business done has been rather limited. Berlin has presented very few transactions, but Cologne has been firmer. At Paris, rough zinc has been very firmly held, at 19*l.* 4s. per ton. The Hamburg market, which has for some time been quiet, has been more animated of late, in consequence of favourable advices received from France. At Breslau the article has also been very firm, and on the markets of Berlin, Stettin, and Cologne business is effected readily at the quoted rates.

We return to M. Desprès' interesting observations on the MIXTURE OF METALS. Allied to other metals, or completely pure, nickel is always more malleable than iron, and also as resisting; it is ductile to the same degree as silver; it rolls, and can, like iron, acquire a fibrous or grained texture under the same conditions. It can be worked warm, like iron, and cold, like silver. Effects of polish can be secured with it similar to those attained with silver, even without the aid of galvanisation. It can even give the colour and brilliancy of silver to mixtures into which it enters, although, perhaps, in small quantities. A mixture, for instance, of nickel, copper, and zinc or iron, which contains only 12 to 15 per cent. of nickel, is completely white. The mixture of nickel with copper and zinc has yielded most precious results; but as it always happens in connection with the introduction into the usages of life of a new matter, little known, and of a certain price, industry has shown itself in the employment of nickel as prudent as it has been parsimonious. Thus, in examining the series of new mixtures having nickel for their basis, it is observable at the outset that the dose of nickel employed was very small, and an increase may be noticed in proportion as the mixtures advanced in favour, until nickel emancipated, so to speak, from the triple guardianship of iron, copper, and zinc appeared at last alone, seeking to dethrone silver in the majority of its applications. Five years since, a metallic piece into which nickel entered was not allowed to circulate without its being previously galvanised—that is to say, without its being covered with a bed of silver of more or less thickness, according to the purpose to which it was intended to be applied, and according also to the greater or less quantity of nickel which it contained. This galvanisation was not without its utility in cases in which the quantity of nickel entering into the mixture did not exceed 10 per cent., as was generally the case; but now there is no necessity to employ any silvering process, as pure nickel bears too close a resemblance to silver itself. The success of nickel is complete, and no one will dream of contesting its triumph, as silver costs ten times as much as nickel, while the expense of manipulation remains the same. Nickel now serves to finish and set off the most delicate pieces of clockwork and jewellery and optical apparatus, and the constructors of instruments of precision have also recourse to this new metal, from which, again, the carriage manufacture and many other industries are also deriving advantages. Its scarcity is the only cause of the moderation with which it is still employed, but the day will come when it will be more abundant, and then it will be eagerly received and utilised. Nickeliferous minerals are far from abundant in themselves, and moreover, with some few exceptions, the quantities of nickel contained in them are so slight that they can rarely be worked at a profit if they do not possess in abundance some other metal more or less precious. Nickel is found in its native state in meteoric stones, but always allied with iron. Nickel is always found in combination with sulphur or arsenic, or with the two combined, and sometimes with antimony or silica. The first and oldest nickel minerals employed were masses of meteoric iron, in which the metal was found in its native state. Amongst other minerals, the only ones which have yet been worked with a profit are arsenics, which are the most rich; mixtures of antimony and sulphur come next, and all other minerals in which nickel is found are only curiosities of the laboratory. In Germany, in the Hars in Hesse, and at Tunaberg, in Sweden, mines of cobalt are worked regularly, and the residue of the treatment of these minerals for smalt have furnished the comparatively unimportant quantities of nickel which have been made available for consumption. More recently—*i. e.*, within three or four years—rich mines of cobalt and nickel have been met with in Piedmont. These mines, specimens from which were only to be seen in laboratories, had been closed for 100 years, and the liberty granted by recent Italian legislation for researches and workings has just made available for industry the richest nickeliferous minerals—combining nickel, cobalt, and iron—which the world has yet seen. An enormous mass of nickeliferous sulphur, of an average richness of 4 to 5 per cent., has also been worked for eight years. Everything, then, induces the conclusion that nickel is destined to play a very important part in modern industry, especially in connection with the arts which employ metallic mixtures.

We have noted above that the Syndicate of Belgian works has just obtained a contract for 25,000 tons of rails, and 30 locomotives, for the new South Italian Railway Company. This is the boldest enterprise of the kind yet conceived in Italy, embracing, as it does, no less than 810¾ miles of railway. The network was solicited, in the first instance, by the house of Rothschild, but national *amour propre* induced the Parliament of Turin to grant the concession to Count de Bastogi, and a number of purely Italian allies. The question now remaining to be solved is whether they can raise the necessary funds. That they can do so in Italy is quite out of the question, and they are appealing for subscriptions for shares and obligations to all the "places" of Europe. If they should succeed in obtaining the 10,000,000*l.* which they require, the order now secured must be regarded as one of the first of a long series; and probably this will be the case, sooner or later, even should Count de Bastogi and his friends find themselves face to face with, for the present, insuperable obstacles.

PREVENTION OF COLLIERY ACCIDENTS.





The desirability of preventing, as far as practicable, the frequent recurrence of accidents in collieries being universally acknowledged, some importance naturally attaches to all propositions calculated or intended to attain that end. Mr. James Rae, of the Greenwich Iron-ship Building Yard, writes that the dreadful accidents which so frequently occur in mines have cost him many serious reflections, and after long study, and considerable expense, he has arrived at the conclusion that most of the coal pit accidents might be avoided with proper care, and a little more outlay at first, which would, no doubt, be found to be the cheapest in the end. Should his suggestions be found useful for the benefit of his fellowmen, it will afford him great pleasure. Mr. Rae does not claim absolute novelty for his design; but relies upon its utility to secure its adoption, and maintains that the extra first cost will be more than compensated by subsequent economy.

The colliery manager and coalowner will readily judge of the great utility of Mr. Rae's design, when they learn that he proposes to employ two large air tubes within the shaft, such tubes not occupying more than one-half of the diameter of the shaft; to use a safety-cage to prevent accident from the breakage of the rope, and a disengaging catch to prevent overwinding; and to provide a ladder within each air-tube, to enable the colliers to escape in case of emergency. Mr. Rae proposes that the main shaft shall be provided with an iron pipe on each side, the outside of such pipes being designed to form guides for the cage; the guides are also furnished with ratchet teeth, which an apparatus on the cage itself takes into in case of the breakage of the rope. The pipes are also intended to be used for pumping out the gases and foul air, so that fresh air may rush down the shaft to supply their place; and in cases of emergency they become safety-ladders for the escape of the miners. Where Mr. Rae's designs are applied as improvements, with existing arrangements, he recommends that vertical shafts should have cast-iron tubbing, formed of flanged segments bolted together, and caulked with cement. He considers that the use of iron tubbing would pave the way to the introduction of escape pipes. As to the guides on the pipes, he states that they might be "either cast on the pipes, or be bolted to them, being in either case planed perfectly true. The faces of the guides should both be cast with teeth upon them in the usual form of the ratchet, and be of about 4-in. pitch and 12-in. broad. The permanent hoist carriage should be made of wrought-iron, with guide-blocks fitted on either side to fit the vertical guides on the tubes. The guide blocks might be furnished with friction rollers, so as to reduce friction in ascent or descent to a minimum. On the under side of the carriage there should be fitted two catches or palls, working in slots, or grooves. The palls would be kept out of gear, so as to allow the free motion upwards or downwards of the carriage, but by the arrangement he proposes they would be relieved the instant the hoist rope or chain broke, and locking themselves in the teeth of the vertical ratchet, would suspend the carriage until it was again made fast to the repaired or replaced rope." The palls are thrown forward by self-acting springs.

In the above diagrams, Fig. 1 is a sectional elevation of the main shaft, showing the escape tubes; Fig. 2 is another sectional view, representing the front of the rachet-guide, and the side of the exhaust fan; Fig. 3, a sectional plan of main shaft through the exhaust-pipes and pump; Fig. 4, plan of main shaft with the two exhaust fans, or blasts, for these may be used for sucking or blowing; Fig. 5, cross-section of main shaft; Fig. 6, side elevation of fans; and Fig. 7, vertical section, showing one of the pipes in the act of being used as an escape ladder. Mr. Rae considers that the existence of such contrivances as these would have permitted every man and boy to have escaped at Hartley. A, represents a loaded coal wagon; B, escape-door at bottom of pipe; C, escape-door at top of pipe; D, front elevation of disconnecting hook; E, entrance to the pit at foot of shaft; F, ladders by which to enter the escape-pipes; and G, exhaust-pipes underground.

IRONWORKS IN AMERICA.—The manufacture of iron in the United States may be divided into three departments—first, the blast furnaces using anthracite coal, charcoal, raw or coked bituminous coal; second, bloomeries or mountain forges, which turn ore or cast-iron into blooms or malleable iron; and, third, rolling mills converting these into bar, rod, sheet, and nail-plate iron, and into rails. In 1857 the works of these kinds amounted to about 1131—viz., 121 anthracite furnaces, 500 charcoal and coke furnaces, 300 forges, and 210 rolling mills; and the entire production of iron was about 783,000 tons—a decrease upon the previous year of 73,235 tons (for in 1856 the total domestic produce of pig and of rolled and hammered iron was 856,235 tons). In 1859 there were only eight States of the Union destitute of ironworks—Mississippi, Louisiana, Florida, Texas, Iowa, Minesota, California, and Oregon. The remaining 25 are employing 560 furnaces, 389 forges, 210 rolling mills; in all 1159, producing 840,000 tons—an increase in two years of 28 works, and 57,000 tons of iron. In 1856 the Pennsylvania ironworks produced 243,484 tons of anthracite iron; in 1857, 237,318 tons; in 1851, 185,000 tons; and in 1859, 286,342 tons. To this may be added the production of charcoal iron, amounting to 33,500 tons. The fall in the manufacture of 1858 was caused by the crisis of the previous year, produced by over speculation in the West. The quantity of iron of all kinds, used in every form of manufacture in the United States, was calculated, in 1856, to be 1,330,548 tons. Of this quantity, 817,356 tons were rolled and hammered iron, 298,275 tons of which were imported, the remaining 519,081 tons being domestic produce. The domestic pig-iron produced in the same year was 337,154 tons, and of foreign 56,402 tons. In 1859 there was a marked increase in the production of Pennsylvania rolling mills; large orders were received for rails from the South and West. The railroads in those parts of the Union had originally been mainly constructed of imported rails, of a cheap and inferior quality, which had soon become unfit for use, and it was soon discovered to be better policy to pay a high price for more durable iron. The larger rolling mills for railway iron in Pennsylvania are the Cambrian Mills, at Johnstown; the Phœnix Iron Company, at Phœnixville; the Montour Mills, at Danville; the Lackawanna Mills at Scranton; and the Rough and Ready, at Danville. The production of rails in 1859 was 104,350 tons; in 1858, 65,500 tons; in 1857, 70,000 tons; and in 1856, 76,300 tons. During the latter part of 1857 the mills were wholly or partially closed. The activity of the iron manufacture in Pennsylvania continued during the first part of 1860, but since October in that year it has, of course, experienced a severe check. Many of the mills that had stopped work through the secession movement have again resumed active operations, especially those devoted to the rolling of plates. The demand upon them for Government iron-plated vessels has been greater than the capacity for such mills to supply.

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